
**Apprenticeship
In-school Curriculum Standard**

Pool & Spa/Hot Tub Service Technician

Level 2 - Advanced

237S



**Apprenticeship
In-school Curriculum Standard**

Pool & Spa/Hot Tub Service Technician

Level 2 - Advanced

237S

Implementation date: September 2010
Printing date: April 2010

ISBN 978-1-4435-2261-8 (Print)
ISBN 978-1-4435-2262-5 (PDF)

 Printed on recycled paper

© Queen's Printer for Ontario, 2010



TABLE OF CONTENTS

Introduction	5
Program Summary of Reportable Subjects	6
S1113.0 Applied Trade Safety Practices	7
S1113.1 Identify safety regulations that are applicable to Pool & Spa/Hot Tub Service Technician	9
S1113.2 Identify safety procedures and practices as required on the worksite	9
S1113.3 Identify safety procedures when handling and mixing chemicals, paints, and solvents	10
S1113.4 Identify required protective clothing and gear	10
S1113.5 Identify fire emergency procedures.....	10
S1113.6 Identify basic first aid and reporting procedures	10
 S1114.0 General Servicing and Maintenance Practices	 11
S1114.1 Demonstrate procedures for completing site evaluations	13
S1114.2 Describe use and maintenance of speciality trade tools and equipment.....	14
S1114.3 Identify housekeeping procedures for the work site.....	15
S1114.4 Describe techniques for troubleshooting techniques at the work site	15
S1114.5 Demonstrate methods for calculating measurements of pool or spa/hot liners and covers.....	15
S1114.6 Describe energy auditing and conservation procedures and techniques	16
S1114.7 Describe advanced leak detection principles and repair procedures for pools and spa/hot tubs	17
 S1115.0 Basic Principles of Project Management	 18
S1115.1 Describe basic business terminology.....	20
S1115.2 Describe basic business management principles	20
S1115.3 Describe basic servicing and maintenance job-costing and reporting procedures	21
S1115.4 Describe basic principles of time management	21
S1115.5 Describe basic principles of risk management.....	22
S1115.6 Describe procedures for estimating a servicing or maintenance job.....	22
S1115.7 Describe procedures for writing up and reporting a servicing and maintenance job	23
S1115.8 Describe elements of preventative maintenance of pool and spa/hot tubs	23

S1116.0	Advanced Water Chemistry and Balancing.....	24
S1116.1	Identify various recreational water illnesses and prevention procedures.....	26
S1116.2	Describe alternative water treatment methodologies	26
S1116.3	Describe elements and applications of specialty chemicals for water balancing	27
S1116.4	Identify problems than can occur when performing water balancing procedures.....	27
S1116.5	Perform calculations for water chemistry balancing.....	28
S1117.0	Customer Service and Communications	29
S1117.1	Identify elements and features of effective servicing and maintenance	30
S1117.2	Describe characteristics of effective customer service practices	31
S1117.3	Describe selling and servicing skills.....	31
S1117.4	Demonstrate use of electronic equipment	32
S1118.0	Automation and Controls.....	33
S1118.1	Describe functions and application of pool and spa/hot tub controls and automation.....	35
S1118.2	Describe functions and operational procedures for chemical controls, readers, and feeders.....	36
S1118.3	Describe functions and operational procedures for automatic covers	36
S1118.4	Describe functions and operational procedures for environmental controls	37
S1119.0	Plumbing Servicing and Maintenance	38
S1119.1	Describe function and application of water hydraulics	40
S1119.2	Describe functions and operations of pool and spa/hot tub feature combinations	41
S1119.3	Describe the servicing and maintenance of in-floor cleaning systems	41
S1119.4	Describe functions and operations of hydrotherapy jets	42
S1119.5	Identify governing legislation for the servicing and maintenance of gas piping	42

S1120.0	Pool and Spa/Hot Tub Structural Maintenance	43
S1120.1	Describe methods for repairing and renovation of pool and spa/hot tub structures and components.....	45
S1120.2	Describe methods for replacing vinyl liners	46
S1120.3	Describe methods for repairing pool and spa/hot tub structural components	46
S1120.4	Describe methods for repairing pool and spa/hot tub interior surfaces	47
S1121.0	Advanced Electrical Systems	48
S1121.1	Describe troubleshooting techniques of electrical systems and components	49
S1121.2	Describe operations and functions of pool and spa/hot tub lighting system and components.....	51
S1121.3	Describe operations and functions of spa/hot tub packs.....	51
S1121.4	Describe maintenance procedures of motors and components.....	52
Glossary of Terms.....		53

Introduction

This curriculum standard for the Pool and Spa/Hot Service Technician Trade – Level 2 Advanced, is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 9 reportable subjects. The Program Summary of Reportable Subjects chart summarizes the training hours for each reportable subject. The curriculum identifies only the learning that takes place off-the-job.

The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards. Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on the work site.

Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to ensure that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

**Program Summary of Reportable Subjects
237S - Level 2 – Advanced**

Number	Reportable Subjects	Hours Theory	Hours Practical	Hours Total
S1113	Applied Trade Safety Practices	6	0	6
S1114	General Servicing and Maintenance Practices	16	8	24
S1115	Basic Principles of Project Management	24	12	36
S1116	Advanced Water Chemistry and Balancing	24	6	30
S1117	Customer Service and Communications	15	6	21
S1118	Automation and Controls	27	6	33
S1119	Plumbing Servicing and Maintenance	24	6	30
S1120	Pool and Spa/Hot Tub Structural Maintenance	21	9	30
S1121	Advanced Electrical Systems	24	6	30
	Total	181	59	240

Number:	S1113.0
Reportable Subject:	APPLIED TRADE SAFETY PRACTICES
Duration:	Total 6 hours Theory 6 hours Practical 0 hours
Prerequisites:	Grade 12
Content:	S1113.1 Identify safety regulations that are applicable to Pool & Spa / Hot Tub Service Technician. 1/0 hrs S1113.2 Describe safety procedures and practices as required on the worksite. 1/0 hrs S1113.3 Describe safety procedures when handling and mixing chemicals, paints and solvents. 2/0 hrs S1113.4 Describe use of required protective clothing and gear. 1/0 hrs S1113.5 Identify fire emergency procedures. 0.5/0 hrs S1113.6 Identify basic first aid and reporting procedures. 0.5/0 hrs
Evaluation & Testing:	Assignments related to theory and appropriate application skills Minimum of one mid-term test during the term Final exam at end of term Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
100%	0%	100%

Instructional and Delivery Strategies:

- Lecture
- Classroom workshops
- Video
- Computer Based Training
- E-Learning

Reference Materials:

- WHMIS Handbook
- Occupational Health and Safety Act
- Transportation of Dangerous Goods
- TSSA
- ESA

S1113.0 Applied Trade Safety Practices

Duration: Total 6 hours Theory 6 hours Practical 0 hours

Cross Reference to Service Technician Training Standards:

2.10, 3.10, 4.08, 5.10, 6.11, 7.05, 7.06, 7.08, 7.09, 8.04, 8.05, 8.06, 8.07, 8.09

GENERAL LEARNING OUTCOMES

Upon successful completion, the apprentice or trainee is able to describe practices to maintain a safe work site for self and others that complies with current government regulations.

LEARNING OUTCOMES AND CONTENT

S1113.1 Identify safety regulations that are applicable to Pool & Spa/Hot Tub Service Technician. (1/0 hrs)

Identify pertinent safety legislation including:

- Occupational Health and Safety Act
- Workplace Hazardous Materials Information System
- Transportation of Dangerous Good Regulations
- Workers Safety and Insurance Board
- Technical Standards and Safety Authority
- Electrical Standards Authority

S1113.2 Identify safety procedures and practices as required on the worksite. (1/0 hrs)

Identify safe working procedures including:

- lifting techniques
- working conditions
- handling of tools and equipment
- handling of hazardous materials
- fire protection
- ventilation
- good housekeeping

LEARNING CONTENT:

- S1113.3 Identify safety procedures when handling and mixing chemicals, paints and solvents. (2/0 hrs)**
- S1113.4 Identify required protective clothing and gear. (1/0 hrs)**
- S1113.5 Identify fire emergency procedures. (0.5/0 hrs)**
- S1113.6 Identify basic first aid and reporting procedures. (0.5/0 hrs)**

Number: **S1114.0**

Reportable Subject: **GENERAL SERVICING AND MAINTENANCE PRACTICES**

Duration: Total 24 hours Theory 16 hours Practical 8 hours

Prerequisites: Grade 12

Content:

S1114.1	Demonstrate procedures for completing site evaluations. 2/1 hrs
S1114.2	Describe use and maintenance of specialty trade tools and equipment. 1/1 hrs
S1114.3	Describe housekeeping procedures for the work site. 1/0 hrs
S1114.4	Describe techniques for troubleshooting at the work site. 3/1 hrs
S1114.5	Demonstrate methods for calculating measurements of pool or spa/hot tub liners and covers. 3/2 hrs
S1114.6	Describe energy auditing and conservation procedures and techniques. 2/1 hrs
S1114.7	Describe advanced leak detection principles and repair methods for pools and spas/hot tubs. 4/2 hrs

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
66%	33%	100%

Instructional and Delivery Strategies:

- Lecture
- Classroom workshops
- Video
- Computer Based Training
- E-Learning

Reference Materials:

- Manufacturers' Technical Manuals
- Ministry of Transportation Legislation
- APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
- APSP Builders Reference Manual

S1114.0 General Servicing And Maintenance Practices

Duration: Total 24 hours Theory 16 hours Practical 8 hours

Cross Reference to Service Technician Training Standards:

2.01-2.10; 3.01-3.10; 4.01- 4.08; 5.01-5.10; 6.01-6.11; 7.01-7.09; 8.01-8.09

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to describe general practices for servicing and maintaining pools and spa/hot tubs.

CURRICULUM OUTCOMES:

S1114.1 Demonstrate procedures for completing site evaluations. (2/1hrs)

Describe procedures for developing a detailed site evaluation including:

- notes
- observations
- measurements
- equipment location and identification
- switches
- pumping equipment
- filter
- emergency shut-offs
- feeders
- storage facilities
- chemicals
- utilities locations
- public facilities
- dangerous or unsafe conditions
- non-conformance of equipment installation or location

Demonstrate the completion of detailed site plans and sketches which includes:

- scale drawings
- detailed notes and checklist

Describe basic surveying techniques including:

- triangulation measurement
- dumpy levels
- laser levels
- surveying rod measurements

LEARNING CONTENT:**S1114.2 Describe use and maintenance of specialty trade tools and equipment. (1/1 hrs)**

Describe the safe operation of applicable specialty trade tools including:

- hand tools
 - liner pullers
 - PVC pipe cutter
 - hydrotherapy jet tools
- electrical tools
 - heat guns
 - liner setting vacuums
 - pipe blowers

Describe operations and functions of fuel-powered tools and equipment including:

- gas pumps
- pressure washers
- cut off saws
- compressors

Describe maintenance procedures for specialty tools including:

- care and upkeep
- routine maintenance
- application
- manufacturer's specifications

Develop checklists for tool repair and maintenance including:

- logbooks
- warranty registrations
- record keeping

LEARNING CONTENT:**S1114.3 Identify housekeeping procedures for the work site. (1/0 hrs)**

Describe general housekeeping practices for work site including:

- daily tasks
- safety hazards

Describe techniques for dismantling and restoring the worksite environment including:

- landscaping
- fences
- decking
- interlocking stone
- groundwork/sod restoration

S1114.4 Describe techniques for troubleshooting at the work site. (3/1 hrs)

Identify tools and methods for troubleshooting using:

- flow charts
- schematic drawings
- ladder diagrams
- manufacturer's specifications

S1114.5 Demonstrate methods for calculating measurements of pool or spa/hot tub liners and covers. (3/2 hrs)

Identify types of covers for pool or spa/hot tubs including:

- pool and insulating safety
- automatic
- fitted
- overlapped
- solar
- spa/hot tub thermal covers
- roll-up

Demonstrate procedures for calculating dimensions using:

- triangulation
- scale drawings
- linear measurement
- interior profiling
- perimeter measurements

LEARNING CONTENT:

S1114.6 Describe energy auditing and conservation procedures and techniques. (2/1 hrs)

Describe energy auditing procedures for:

- electrical consumption
 - motors
 - blowers
 - lights
 - heater elements
- heat loss
 - piping
 - water surfaces
 - structures
- energy consumption of fossil fuel heaters

Describe energy conservation techniques and applications including:

- timers
- covers
- equipment sizing
- conservation
- flow reversal plumbing
- heat recovery systems
- planned equipment location
- insulation
- high efficiency
- gas heaters
- two speed motors
- variable speed motors

LEARNING CONTENT:

S1114.7 Describe advanced leak detection principles and repair methods for pools and spas/hot tubs. (4/2 hrs)

Describe advanced leak detection methodologies for pools and spas/hot tubs including:

- electronic detection
- geophones/sonic
- pressure testing
- water testing
- gas test

Identify leak problems that can occur in pool and spa/hot tub structures including:

- metal
- concrete
- acrylic
- wood

Identify detection procedures for leaks in spa/hot tub circulating systems including:

- piping
- equipment
- fittings

Identify detection procedures for leaks in spa/hot tub air induction systems including:

- piping
- equipment
- fittings

Describe advanced repair techniques for leaks in pool or spa/hot tub structures including:

- electronic detection
- geophones/sonic
- pressure testing
 - water test
 - gas test

Number: **S1115.0**

Reportable Subject: **BASIC PRINCIPLES OF PROJECT MANAGEMENT**

Duration: Total 36 hours Theory 24 hours Practical 12 hours

Prerequisites: Grade 12

Content: S1115.1 Describe basic business terminology. **3/0 hrs**

S1115.2 Describe basic business management principles. **3/0 hrs**

S1115.3 Describe basic servicing and maintenance job-costing and reporting procedures. **3/0 hrs**

S1115.4 Describe the basic principles of time management. **3/0 hrs**

S1115.5 Describe basic principles of risk management. **3/0 hrs**

S1115.6 Describe procedures for estimating a servicing or maintenance job. **3/3 hrs**

S1115.7 Describe procedures for writing up and reporting a servicing and maintenance job. **3/6 hrs**

S1115.8 Describe elements of preventative maintenance for pool and spa/hot tubs. **3/3 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
66%	33%	100%

Instructional and Delivery Strategies:

- Lecture
- Classroom workshops
- Video
- Computer Based Training
- E-Learning

Reference Materials:

- Manufacturers' Technical Manuals
- APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
- Project Management for Builders and Contractors
- Aquatic Facility Operator 3rd Edition

S1115.0 Basic Principles of Project Management

Duration: Total 36 hours Theory 24 hours Practical 12 hours

Cross Reference to Service Technician Training Standards:

2.01, 2.02, 2.04-2.09, 2.11; 3.01-3.09, 3.11; 4.01-4.07, 4.09; 5.01-5.09,
5.11; 6.01-6.10, 6.13; 7.01-7.08, 7.10; 8.01-8.08, 8.10

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to describe basic project management practices as applicable to servicing and maintenance of pools or spa/hot tubs.

CURRICULUM OUTCOMES:**S1115.1 Describe basic business terminology. (3/0 hrs)**

Identify basic business practices terminology including:

- accounting
 - receivable
 - payables
 - collection
 - reporting
- industry
 - suppliers
 - distribution
 - manufacturing
- sales
 - marketing
 - promotion

S1115.2 Describe basic business management principles. (3/0 hrs)

Describe internal company organization and reporting structures including:

- administration
- managers
- supervisors
- sub-contractors

LEARNING CONTENT:**S1115.3 Describe basic servicing and maintenance job-costing and reporting procedures. (3/0 hrs)**

Describe elements of job-costing and reporting procedures including:

- maintenance time
- servicing time
- repairs
- parts
- labour costs
- inventories
- material usage
- tools
- equipment expense
- inspection sheets
- budget analysis
- deficiency reports
- equipment
- cost of permits
- cost of bonds
- applicable taxes
- cost of sub-trades
- completion reports
- warranty requirements

S1115.4 Describe basic principles of time management. (3/0 hrs)

Describe basic time management principles including:

- service call scheduling
- maintenance and repair scheduling
- time frames
- task prioritization
- route planning
- data management
- labour recording

LEARNING CONTENT:

S1115.5 Describe basic principles of risk management. (3/0 hrs)

Describe basic risk management principles including:

- property protection
- safety policies
- standard operating procedures
- public safety
- vehicle and equipment protection
- inventory control
- fraud
- theft
- personal protection

S1115.6 Describe procedures for estimating a servicing or maintenance job. (3/3 hrs)

Describe elements of preparing and documenting a job estimate which includes:

- materials
- labour
- tools
- equipment
- permits

Demonstrate the completion of job estimating documentation.

LEARNING CONTENT:

S1115.7 Describe procedures for writing up and reporting a servicing and maintenance job. (3/6 hrs)

Identify elements of project management including:

- material lists
- times sheets
- work schedules
- sub-contractor coordination
- permit acquisition
- equipment scheduling

Describe project management documents including:

- critical path summary
- master schedules
- deficiency lists

Demonstrate the completion of project management documentation.

S115.8 Describe elements of preventative maintenance of pool and spa/hot tubs. (3/3 hrs)

Describe elements of preventative maintenance plans including:

- frequency
- scheduling
- procedures
- equipment cards
- master calendar

Describe a preventative maintenance plan for pool and spa/hot tub equipment including:

- scheduling
- inspections
- service requirements
- replacement
- maintenance costs
- sub trades
- permits

Demonstrate the completion of a preventative maintenance plan and schedule.

Number: **S1116.0**

Reportable Subject: **ADVANCED WATER CHEMISTRY AND BALANCING**

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Prerequisites: Grade 12

Content: S1116.1 Identify various recreational water illnesses and prevention procedures. **5/0 hrs**

S1116.2 Describe alternative water treatment methodologies. **5/0 hrs**

S1116.3 Describe elements and applications of specialty chemicals for water balancing. **5/2 hrs**

S1116.4 Identify problems that can occur when performing water balancing procedures. **4/0 hrs**

S1116.5 Perform calculations for water chemistry balancing. **5/4 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
75%	25%	100%

Instructional and Delivery Strategies:

Lecture
Classroom workshops
Video
Computer Based Training
E-Learning

Reference Materials:

APSP Basic Pool & Spa/ Hot Tub Technology 3rd Edition
Aquatic Facility Operator 3rd Edition
WHMIS Handbook
Occupational Health and Safety Act - WHMIS Handbook
Manufacturers' Technical Manuals

S1116.0 Advanced Water Chemistry And Balancing

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Cross Reference to Service Technician Training Standards:

2.01, 2.02, 2.04-2.09, 2.11, 3.01-3.09, 3.11, 4.01-4.07, 4.09,
5.01-5.09, 5.11, 6.01-6.10, 6.13, 7.01-7.08, 7.10, 8.01-8.08, 8.10

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to describe and demonstrate all elements and procedures for balancing and maintaining water chemistry,

CURRICULUM OUTCOMES:

S1116.1 Identify various recreational water illnesses and prevention procedures. (5/0 hrs)

Describe various recreational water illnesses including:

- Pseudomonas folliculitis
- Cryptosporidium
- Legionnaire's Disease

Describe various recreational water treatment to prevent disease including:

- sanitation
- filtration
- oxidation

S1116.2 Describe alternative water treatment methodologies. (5/0 hrs)

Describe the function and application of alternative water treatments including:

- ozone
- ultraviolet
- electrolysis of salts
- ionizers

LEARNING CONTENT:**S1116.3 Describe elements and applications of specialty chemicals for water balancing. (5/2 hrs)**

Describe elements and application of various specialty chemicals including:

- algaecides
- sequestering agents
- flocculants
- clarifiers
- filter cleaners
- de-foamers
- enzymes
- cyanuric acid

Describe methods for applying specialty chemicals.

S1116.4 Identify problems that can occur when performing water balancing procedures. (4/0 hrs)

Identify problems that can occur with the water balancing process including:

- algae
- nitrates
- dissolved solids
- over-chlorination
- staining
- turbidity
- foaming
- dissolved minerals
- ph

Describe procedures for correcting water balancing problems including:

- chemical addition
- draining water

Describe methods of using and adding pool chemicals including:

- mixing
- dispersal
- personal protection equipment
- environmental concerns

LEARNING CONTENT:

S1116.6 Perform calculations for water chemistry balancing. (5/4 hrs)

Describe methods for adjusting and balancing water chemistry.

Calculate requirements for pool water balance adjustment including

- dilution ratios
- dosage tables and charts
- balancing ratios
- sanitizer levels

Pool and Spa/Hot Tub Service Technician

Level 2 Advanced

Number: **S1117.0**

Reportable Subject: **CUSTOMER SERVICE AND COMMUNICATIONS**

Duration: Total 21 hours Theory 15 hours Practical 6 hours

Prerequisites: Grade 12

Content:

- 1117.1 Identify elements and features of effective servicing and maintenance scheduling. **3/1 hrs**
- 1117.2 Describe characteristics of effective customer service practices. **3/1 hrs**
- 1117.3 Describe selling and servicing skills. **3/1 hrs**
- 1117.4 Demonstrate use of electronic equipment. **6/3 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
60%	40%	100%

Instructional and Delivery Strategies: Lecture
Classroom workshops
Video
Computer Based Training
E-Learning

Reference Materials: Manufacturers' Technical Manuals
APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
Customer Service Manuals

S1117.0 Customer Service And Communications

Duration: Total 21 hours Theory 15 hours Practical 6 hours

Cross Reference to Service Technician Training Standards:
2.12, 3.12, 4.10, 5.12, 6.12, 7.11, 8.11

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to communicate clearly and demonstrate customer services.

CURRICULUM OUTCOMES:

S1117.1 Identify elements and features of effective servicing and maintenance. (3/1 hrs)

Describe elements and features of effective service scheduling including:

- cost savings
- time saving
- customer satisfaction

Identify factors of servicing and maintenance scheduling and routing including:

- service identification
- prioritization
- geographical location and access
- supplies
- customer requests

Describe a servicing or maintenance schedule.

LEARNING CONTENT:**S1117.2 Describe characteristics of effective customer service practices. (3/1 hrs)**

Identify elements and characteristics of customer service practices including:

- telephoning procedures
- customer complaints
- personal conduct
- explaining warranties to customers
- collection
- invoicing
- notification
- contact
- response times

S1117.3 Describe selling and servicing skills. (3/1 hrs)

Identify procedures for developing of sales opportunities including:

- equipment sales and upgrades
- additional services
- chemical replenishment
- accessories and complementary items
- new product introductions
- estimating

Describe use of sales tools including

- brochures
- catalogues
- samples
- quote forms

Describe sales techniques including:

- verbal
- written proposals
- product demonstration

LEARNING CONTENT:

S1117.4 Demonstrate use of electronic equipment. (6/3 hrs)

Describe the use of electronic equipment to identify:

- estimates
- product identification
- site evaluations
- problem identification
- customer records
- service work documentation
- sales
- service or maintenance problems
- scheduling
- invoicing
- tool requirements
- inventory control
- organizing permits
- coordinating sub-trades
- servicing records
- chemical usage records
- maintenance scheduling
- communication accuracy
- technical support
- equipment monitoring
- customer service improvement

Demonstrate the application of electronic equipment.

Pool and Spa/Hot Tub Service Technician

Level 2 Advanced

Number: **S1118.0**

Reportable Subject: **AUTOMATION AND CONTROLS**

Duration: Total 33 hours Theory 27 hours Practical 6 hours

Prerequisites: Grade 12

Content:

- S1118.1 Describe functions and application of pool and spa/hot tub controls and automation. **7/1.5 hrs**
- S1118.2 Describe functions and operational procedures for chemical controls, readers, and feeders. **7/1.5 hrs**
- S1118.3 Describe functions and operational procedures for automatic covers. **6/1.5 hrs**
- S1118.4 Describe functions and operational procedures for environmental controls. **7/1.5 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
80%	20%	100%

Instructional and Delivery Strategies: Lecture
Classroom workshops
Video
Computer Based Training
E-Learning

Reference Materials: APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
Aquatic Facility Operator Manual 3rd Edition
APSP Builders Reference Manual
Various Manufacturers' Manuals
Controls and Automation Manuals

S1118.0 Automation And Controls

Duration: Total 33 hours Theory 27 hours Practical 6 hours

Cross Reference to Service Technician Training Standards:

3.03-3.09, 5.03-5.09, 7.01-7.08, 8.06, 8.07, and 8.10

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to identify and describe features and applications of pool and spa/hot tub equipment controls and automation.

CURRICULUM OUTCOMES:**S1118.1 Describe functions and application of pool and spa/hot tub controls and automation. (7/1.5 hrs)**

Identify functions and application of digital and analog controls including:

- valve controls
- actuators
- timers
- lighting controls
- water temperature controls
- flow control
- metering
- remote controls
 - infra-red
 - radio frequency

Describe functions and application of digital and analog spa-side control panels including:

- operation
- components
- construction

Identify common problems than can occur with controls including:

- mechanical
- electronic board

Describe procedures for the programming, repair, and maintenance of controls and automation.

LEARNING CONTENT:**S1118.2 Describe functions and operational procedures for chemical controls, readers, and feeders. (7/1.5 hrs)**

Describe functions and operation of automated chemical level reading and recording equipment including:

- ORP meters
- pH meters

Describe functions and operation of automated chemical-level regulating and feeding equipment including:

- liquid chlorine feeders
- chlorine generators
- pH adjusters
- ozone generators
- chlorine gas feeders
- erosion feeders

Identify common problems than can occur with chemical-regulating controls including:

- mechanical
- electronic

Describe procedures for the programming, repair, and maintenance of controls, readers, and feeders.

S1118.3 Describe functions and operational procedures for automatic covers. (6/1.5 hrs)

Describe functions and operation of automatic covers including:

- electric
- hydraulic
- manually driven
- soft
- rigid
- insulating

Identify common problems than can occur with automatic covers.

Describe procedures for the programming, repair, and maintenance of automatic covers.

LEARNING CONTENT:

S1118.4 Describe functions and operational procedures for environmental controls. (7/1.5 hrs)

Describe functions and operational procedures for environmental controls including:

- humidity
- air temperature
- water temperature
- fresh air
- lighting controls

Describe procedures for programming, repair, and maintenance of environmental controls.

Number: **S1119.0**

Reportable Subject: **PLUMBING SERVICING AND MAINTENANCE**

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Prerequisites: Grade 12

Content:

- S1119.1 Describe functions and applications of water hydraulics. **6/2 hrs**
- S1119.2 Describe functions and operations of pool and spa/hot tub water feature combinations. **6/1 hrs**
- S1119.3 Describe servicing and maintenance of in-floor cleaning systems. **4/1 hrs**
- S1119.4 Describe functions and operations of hydrotherapy jets. **6/2 hrs**
- S1119.5 Identify governing legislation for the servicing and maintenance of gas piping. **2/0 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
80%	20%	100%

Instructional and Delivery Strategies: Lecture
 Classroom workshops
 Video
 Computer Based Training
 E-Learning

Reference Materials: Government Legislation
 APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
 Manufacturers' Technical and Training Manuals
 Aquatic Facility Operator Manual 3rd Edition
 APSP Builders Reference Manual

S1119.0 PLUMBING SERVICING AND MAINTENANCE

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Cross Reference to Service Technician Training Standards:

2.03, 2.04, 2.06-2.09, 3.03, 3.04, 3.06-3.09, 4.02-4.07,
5.03-5.09 and 8.06-8.08

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to identify and describe all elements and features of servicing and maintaining pool and spa/hot tub plumbing systems.

CURRICULUM OUTCOMES:

S1119.1 Describe function and application of water hydraulics. (6/2 hrs)

Describe principles of water flow including:

- head and friction loss
- pump curves
- suction lift
- pipe sizing
- equipment sizing
- water features
- fountains

Perform calculations for water flow including:

- head and friction losses
- flow rates
- velocity
- equipment sizing
- pipe sizing

Identify pertinent government regulations for the use of water hydraulics including:

- Health & Environmental
- ANSI
- ASME
- NSF

LEARNING CONTENT:**S1119.2 Describe functions and operations of pool and spa/hot tub water feature combinations. (6/1 hrs)**

Describe functions of water flow specialty applications including:

- waterslides
- vanishing edges
- water features

Identify the components of pool and spa/hot tub water feature combinations including:

- plumbing configurations
- flow control valves

Identify problems that can occur with plumbing components including:

- inadequate flow
- spill
- splashing
- water filtration
- water treatment
- water feature combinations

S1119.3 Describe the servicing and maintenance of in-floor cleaning systems. (4/1 hrs)

Describe the operation and function of in-floor cleaning systems and components including:

- control valves
- cleaning heads

Describe servicing problems that can occur with in-floor cleaning systems including:

- component replacements
- cleaning heads

LEARNING CONTENT:

S1119.4 Describe functions and operations of hydrotherapy jets. (6/2 hrs)

Identify types of hydrotherapy jets including:

- resistance
- current
- venturi jet

Describe the operation and function of hydrotherapy jets including:

- sizing
- flow rates
- applications

Identify problems than can occur with hydrotherapy jets including:

- operation
- leaking
- winterizing

Describe the assembly and disassembly of hydrotherapy jets.

S1119.5 Identify governing legislation and regulations for the servicing and maintenance of gas piping. (2/0 hrs)

Identify governing legislation for the handling of gas piping including:

- TSSA
- OHSA
- TQAA
- ACA

Identify regulations governing the servicing and maintenance of gas piping including:

- TSSA licensing requirements
- notifying sub-trades

Number: **S1120.0**

Reportable Subject: **POOL AND SPA/HOT TUB STRUCTURAL
MAINTENANCE**

Duration: Total 30 hours Theory 21 hours Practical 9 hours

Prerequisites: Grade 12

Content:

- S1120.1 Describe methods for repairing and renovation of pool and spa/hot tub structures and components. **5/3 hrs**
- S1120.2 Describe methods for replacing vinyl liners. **3/0 hrs**
- S1120.3 Describe methods for repairing spa/hot tub structural components. **5/3 hrs**
- S1120.4 Describe methods for repairing pool and spa/hot tub interior surfaces. **6/3 hrs**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
70%	30%	100%

Instructional and Delivery Strategies: Lecture
 Classroom workshops
 Video
 Computer Based Training
 E-Learning

Reference Materials: APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
 Manufacturers' Technical and Training Manuals
 Building Codes
 Government Legislation
 WHMIS Handbook
 Occupational Health and Safety Act

S1120.0 Pool And Spa/Hot Tub Structural Maintenance

Duration: Total 30 hours Theory 21 hours Practical 9 hours

Cross Reference to Service Technician Training Standards: 6.01-6.10 and 8.06

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to identify and describe maintenance and servicing procedures for pool and spa/hot tub structures.

CURRICULUM OUTCOMES:**S1120.1 Describe methods for repairing and renovation of pool and spa/hot tub structures and components. (5/3 hrs)**

Describe methods of repairing metal pool structures including:

- straightening walls
- replacing or repairing walls
- repairing pool bottoms

Describe methods of concrete pool wall structural repairs including:

- crack repair
- fitting replacement

Describe methods of fiberglass pool wall structural repairs including:

- straightening walls
- repairing walls
- repairing pool bottoms

Describe methods of pool coping repairs including:

- replace
- re-grouting
- reforming
- repair

Describe pool structure renovations including:

- stair installation/removal
- lighting repair and installation
- plumbing re-fitting
- water feature addition
- structural redesign and alteration

LEARNING CONTENT:**S1120.2 Describe methods for replacing vinyl liners. (3/0 hrs)**

Describe liner replacement methods including:

- removal
- cutting in of white goods
- interior preparation
- fitting
- setting

Describe liner replacement problems including:

- ground water
- defective fittings
- defective coping
- broken or cracked bottoms
- temperature factors

S1120.3 Describe methods for repairing pool and spa/hot tub structural components. (5/3 hrs)

Describe methods for repairing concrete spa /hot tub structural components including:

- acrylic repair

Describe methods for repairing fiberglass spa/hot tub structural components including:

- acrylic crack repair

Describe methods for repairing metal spa/hot tub structural components including:

- corrosion repair
- section replacement

LEARNING CONTENT:**S1120.4 Describe methods for repairing pool and spa/hot tub interior surfaces. (6/3 hrs)**

Describe methods for repairing the interior finish of concrete pools and spas/hot tubs including:

- painting
- tiling
- plastering
- surface preparation
- acid washing
- waterproofing
- parging

Describe methods for repairing the interior finish of acrylic spas/hot tubs including:

- crack repair
- blister repair

Describe methods for repairing the interior finish of wood spas/hot tubs including:

- liner repair or replacement
- stave replacement

Number: **S1121.0**

Reportable Subject: **ADVANCED ELECTRICAL SYSTEMS**

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Prerequisites: Grade 12

Content:

S1121.1 Describe troubleshooting techniques of electrical systems and components.
6/1.5 hrs

S1121.2 Describe operations and functions of pool and spa/hot tub lighting system and components.
(6/1.5 hrs)

S1121.3 Describe operations and functions of spa/hot tub packs. **(6/1.5 hrs)**

S1121.4 Describe maintenance procedures of motors and components. **(6/1.5 hrs)**

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Module Final Assessment
80%	20%	100%

Instructional and Delivery Strategies: Lecture
 Classroom workshops
 Video
 Computer Based Training
 E-Learning

Reference Materials: APSP Basic Pool & Spa/Hot Tub Technology 3rd Edition
 Manufacturers' Technical and Training Manuals
 Building Codes
 ESA legislation and regulations

S1121.0 Advanced Electrical Systems

Duration: Total 30 hours Theory 24 hours Practical 6 hours

Cross Reference to Service Technician Training Standards:
3.03-3.09, 5.03-5.09, 7.01-7.08, 8.06, 8.07, 8.10

GENERAL LEARNING OUTCOME:

Upon successful completion, the apprentice is able to describe procedures for servicing or maintaining electrical systems and components.

CURRICULUM OUTCOMES:

S1121.1 Describe troubleshooting techniques of electrical systems and components. (6/1.5 hrs)

Identify pertinent legislation and regulations pertinent to electrical systems and components including:

- Occupational Health and Safety Act
- Workers Safety and Insurance Board
- Electrical Standards Authority
- Building Codes

Describe electrical concepts of:

- ground fault circuit interruption (GFCI)
- polarity
- voltage drops
- bonding
- grounding

Identify troubleshooting techniques for electrical systems including:

- amperage checks
- system reset switches
- heater/thermostat linkages
- sensor checks
- electronic circuit boards
- voltage systems

LEARNING CONTENT:**S1121.2 Describe operations and functions of pool and spa/hot tub lighting system and components. (6/1.5 hrs)**

Identify types of pool light fixtures and bulb including:

- dry-niche
- wet-niche
- fiber-optic
- halogen
- LED
- incandescent

Describe servicing of pool and spa/hot tub lighting including:

- multimeter check
- replacement
- continuity check
- wire replacement

S1121.3 Describe operations and functions of spa/hot tub packs. (6/1.5 hrs)

Identify operations and functions of spa/hot tub components and electrical control systems including:

- control boxes
- pumps
- heaters
- blowers
- ozonators
- electronic controller
- electric controller
- thermostats
- switches
- relays
- controller logic devices

Describe electrical requirements for spa/hot tub packs including:

- bonding
- grounding
- wire sizing
- electrical receptacles
- ESA regulations

LEARNING CONTENT:

**S1121.4 Describe maintenance procedures of motors and components.
(6/1.5 hrs)**

Describe diagnostic testing of motors including:

- voltage tests
- load checks
- winding continuity
- capacitor operation
- defective bearings
- defective start switch

Describe techniques for repairing or replacing defective motor components including:

- bearing replacement
- starter replacement
- capacitor replacement

Identify procedures for contacting electrical sub-trades for repair or maintenance of electrical systems and components including:

- Government legislation
- Municipal codes
- inspection requirements
- Permits
- ESA

Glossary of Terms

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CAC	Curriculum Advisory Committee
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
ESA	Electrical Safety Authority (Ontario)
NSF	National Sanitation Foundation
APSP	National Spa & Pool Institute
OBC	Ontario Building Code
OHSA	Occupational Health and Safety Act
TDG	Transportation of Dangerous Goods
TSSA	Technical Standards and Safety Authority
WHMIS	Workplace Hazardous Materials Information System
WSIB	Workplace Safety and Insurance Board

